

during the winter. Monthly records are: March (2), April (2), May (6), June (19), July (43), August (27), September (21), October (6) and November (14).

Rogas molestus Cresson.—A single specimen of this species was reared from *Trichoplusia ni* on alfalfa at Amado in August.

Rogas perplexus Gahan.—Two rearings were obtained, one from *Trichoplusia ni* on alfalfa at Elfrida in July and the other from *Heliothis* sp. on cotton at Safford in August.

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THE PARASITES OF THE CLOVER SEED CHALCID IN THE UNITED STATES¹

(Hymenoptera:Chalcidoidea)

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The clover seed chalcid, *Bruchophagus gibbus* (Boheman), annually causes serious losses to alfalfa and clover seeds throughout the United States. Its destructiveness is reduced by a number of chalcidoid parasites. This paper presents a key for the identification of the clover seed chalcid and its parasites and a brief summary of their areas of recorded occurrence and important sources of published information. The key and figures were prepared by B. D. Burks⁴ and the distribution records are from Muesebeck *et al.* (1951) and Hansen (1955).

The following key to the clover seed chalcid and its parasites in the United States was prepared by Dr. B. D. Burks. This key was based on dry female specimens reared from alfalfa, clover or other

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suitable hosts and is not designed for identification of fresh specimens from field sweepings.

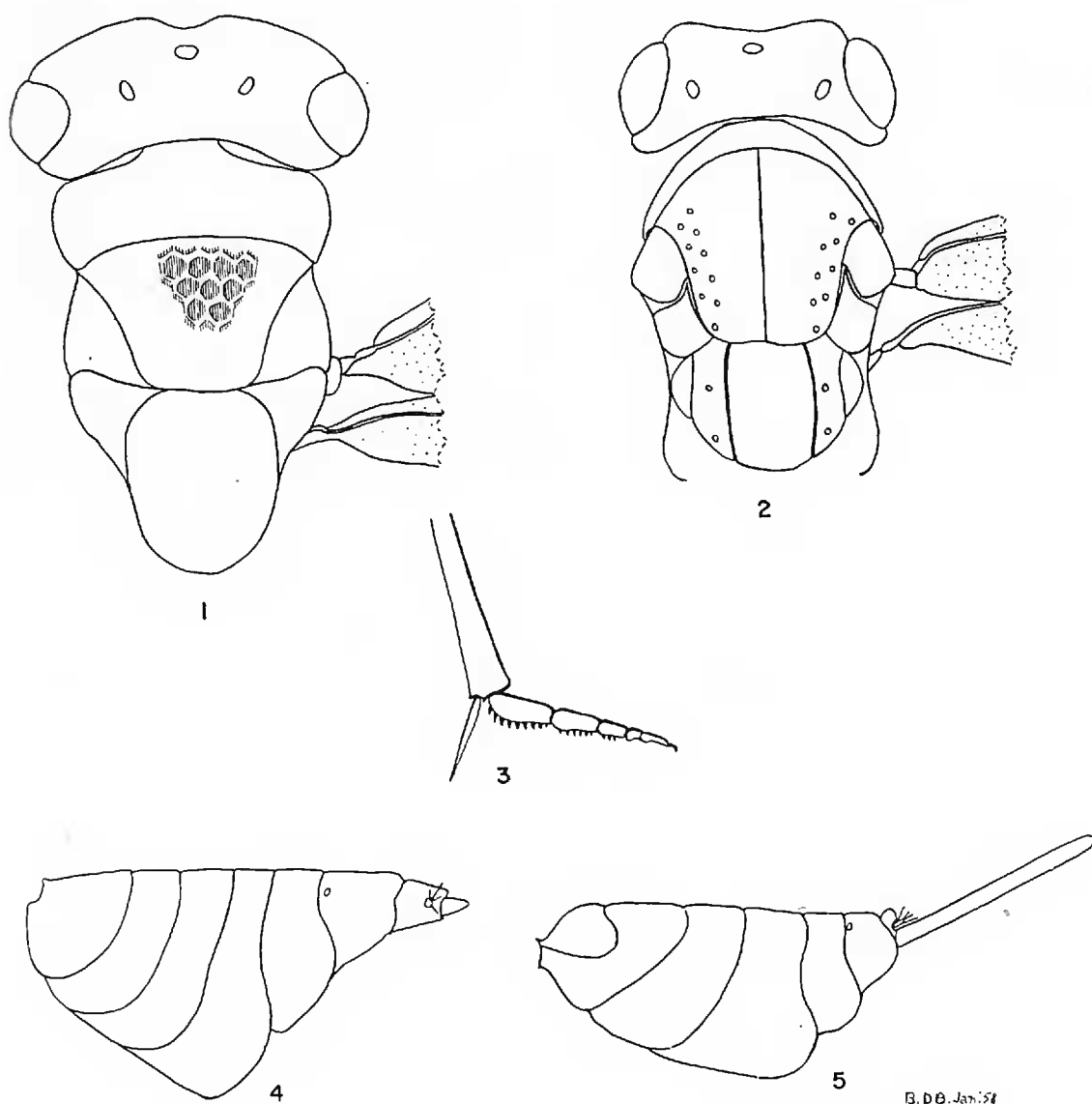
Key to the Clover Seed Chalcid and its North American Parasites

(Females—Dry Reared Specimens)

1. Body dull black; pronotum semi-quadrate and thoracic notum with thimble-like punctations, fig. 1.....*Bruchophagus gibbus* (Boheman)
Body partly or mostly shining metallic green, blue-green, or blue, never dull black; pronotum not semi-quadrate; thoracic notum not with thimble-like punctation 2
2. Virtually wingless, hindwings minute, forewings reduced to a pair of triangular vestiges which are normally held upright.....
.....*Eupelmella vesicularis* (Retzius)
Wings fully developed, forewing long enough to reach or surpass the posterior end of the abdomen..... 3
3. Midtarsus with a ventral comb of short, black spines, fig. 3; mesothorax flattened dorsally and with a pair of longitudinal ridges.....
.....*Eupelmus* sp.
Midtarsus without a ventral comb; thorax without longitudinal ridges.... 4
4. Ovipositor long, projecting for a distance at least one-half as great as length of abdomen, fig. 5..... 5
Ovipositor projecting only slightly, fig. 4..... 7
5. Projecting portion of ovipositor one-half to two-thirds as long as abdomen.....*Liodontomerus perplexus* Gahan
Projecting portion of ovipositor longer than abdomen..... 6
6. Forewing clear.....*Liodontomerus insuetus* Gahan
Forewing with a large, vaguely defined dark spot behind the marginal vein.....*Liodontomerus longfellowi* (Girault)
7. Hind tibia partly dark brown to black; thorax black or navy blue with 4 metallic blue or green spots anteriorly.....
.....*Trimeromicrus maculatus* Gahan
Hind tibia entirely yellow or light tan thorax not black or navy blue with metallic spots..... 8
8. Scutellum with 2 dorsal, longitudinal grooves, fig. 2; tarsus with 4 segments 9
Scutellum without dorsal, longitudinal grooves; tarsus with 5 segments....10
9. Body dark metallic blue; hind femora mostly dark.....
.....*Tetrastichus bruchophagi* Gahan*
Body yellow with bright metallic green spots; hind femora mostly or entirely yellow.....*Tetrastichus venustus* Gahan

* An occasional specimen has the hind tibiae darkened; the heads of species of *Tetrastichus* almost always collapse when the specimens dry.

10. Central area of propodeum shagreened; antenna with 3 ring segments and 5 funicle segments.....*Amblymerus bruchophagi* (Gahan)
 Central area of propodeum almost smooth, with a few obscure, oblique carinae; antenna with 2 ring segments and 6 funicle segments.....*Habrocytus medicaginis* Gahan



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EXPLANATION OF FIGURES

Fig. 1, *Bruchophagus gibbus* (Boheman). Head and thorax, dorsal, showing bases of right wings and some sculpture; Fig. 2, *Tetrastichus bruchophagi* Gahan. Head and thorax, dorsal, showing bases of wings, setal pits, thoracic grooves; Fig. 3, *Eupelmus* sp. Mid tarsus; Fig. 4, *Habrocytus medicaginis* Gahan. Female abdomen, lateral aspect, showing ovipositor, cercus, and seven gastral segments; Fig. 5, *Liodontomerus perplexus* Gahan. Female abdomen, lateral aspect, showing exerted ovipositor, cercus, and seven gastral segments (abdominal segments III-IX). (Figures drawn by B. D. Burks, January 1958.)

FAMILY EULOPHIDAE

TETRASTICHUS BRUCHOPHAGI Gahan

The females are dark blue-green in color except for a yellow apex on each femur and tibia. The tarsi are yellow except for the apical segment, which is dark. The antennae are dark brown and there are three funicular segments. The males are similar to the females except that the antennae have four funicular segments.

This species is generally distributed throughout the United States. It is the most active parasite of the clover seed chalcid in central California. Details of the life history and descriptions of the stages are given by Urbahns (1917). *T. bruchophagi* has also been reported as a hyperparasite of the alfalfa weevil parasite, *bathyplectes curculionis* (Thompson) (Muesebeck, *et al.* 1951).

TETRASTICHUS VENUSTUS Gahan

The females are yellow with metallic green spots. The male is usually all dark metallic green, with the ventral half of the frons yellow.

This is a rare parasite although the recorded distribution includes Arizona, California, Indiana and Iowa. Urbahns (1920) reared this species in small numbers from alfalfa seed but other workers have not found it.

FAMILY EUPELMIDAE

EUPELMUS sp.

Urbahns (1920) records a single larva dissected from an alfalfa seed from Pasadena, California. Other workers have not encountered this species.

EUPELMELLA VESICULARIS (Retzius)

This species is listed as being parasitic on 42 host species, including the clover seed chalcid. Its distribution is recorded as Maine to Virginia and also Colorado, Oregon, Tennessee, Utah and Washington. Sorenson (1934b) found only an "occasional" specimen in Utah. Males are not known from North America.

FAMILY TORYMIDAE

LIODONTOMERUS INSUETUS Gahan

The females are similar to *L. perplexus* except that the fore-

wings are clear with no evidence of a fuscous spot in the median area. The ovipositor is slightly longer than the abdomen, which is bronzy in color and has the tergites tinged with green basally. The males of the three species of *Liodontomerus* look very much alike, but the genus can be recognized in the male by having the cerci exerted and at the apex of abdominal tergite IX, not biscuit-like and located anterior to that margin.

The distribution of this species includes Arizona, California, Kansas, New Mexico and Oklahoma. It is only rarely collected in these states. Some locality records are discussed by Urbahns (1920).

LIODONTOMERUS LONGFELLOWI (Girault)

This species has been often referred to as *L. secundus*. The females of *L. longfellowi* differ from *L. perplexus* in that the segments of the antennal funicle are subquadrate, in that there is always a vaguely defined fuscous spot in the median area of the forewing and in that the ovipositor is distinctly longer than the abdomen. The male is similar to the female except for the short abdomen and other secondary sexual characters.

L. longfellowi is recorded primarily from the northern half of the United States. It has only been found associated with the clover seed chalcid on red clover. The recorded distribution is Idaho, Iowa, Minnesota, Ohio, Oregon, West Virginia (a new record) and Wisconsin. Urbahns (1919) studied the life history of this species.

LIODONTOMERUS PERPLEXUS Gahan

The females of this species have the head and thorax brassy green, the abdomen bronzy above and darker on the sides. The segments of the antennal funicle are broader than long. The forewings may or may not have a cloudy area in the median portion. The ovipositor is about two-thirds as long as the abdomen. The males are similar to the females except that the third flagellar segment is reduced and appears similar to a ring joint and the abdomen is very short and blunt. The upper parts of the legs are darker green than the body with the extremities yellowish.

This species is only associated with the clover seed chalcid

on alfalfa. It is widely distributed, with records from Arizona, California, Colorado, Idaho, Iowa, Nebraska, North Dakota, Oklahoma, South Dakota, Utah and Washington. A detailed description of the stages and the life history is given by Urbahns (1919).

FAMILY PTEROMALIDAE

AMBLYMERUS BRUCHOPHAGI (Gahan)

This species has also been called *Eutelus bruchophagi* Gahan. The female is similar in size and shape to the clover seed chalcid. The head is broad with dark brown eyes and antennae. The head and thorax are blackish-green, the legs are dark brownish or reddish-brown with the tarsi paler. The male is smaller than the clover seed chalcid. Its head and body are a bright metallic green. The antennae are bright yellow with a black club. The eyes are brown and the legs reddish-yellow.

The distribution of this species includes the states of Idaho, Utah, Wyoming and northern California. It emerges earlier in the spring than the clover seed chalcid or its other parasites. Urbahns (1919) discusses the biology and Sorenson (1930) discusses the adults and (1934a,b) gives rearing and sweeping records.

HABROCYTUS MEDICAGINIS Gahan

The female resembles *Amblymerus bruchophagi* in size and general appearance. *H. medicaginis* has two ring segments in the antennae while *A. bruchophagi* has three. *H. medicaginis* is bluish or bronzy green in general coloration. The head is broader than long in width, slightly exceeds the width of the thorax. The antennae are brown. The anterior margin of the pronotum is sharp. The males look very much like *Trimeromicrus maculatus* but can be separated by the difference in the number of ring segments, two in *Habrocytus* and three in *Trimeromicrus*.

This species has been reported from Arizona, California, Connecticut, Idaho, Iowa, Kansas, Minnesota, Nebraska, New Mexico, New York, Nevada, North Dakota, South Dakota, Utah, Washington and Wisconsin. Urbahns (1916) gives a detailed account of the life history of this species and it is mentioned by Sorenson (1930, 1943a,b).

TRIMEROMICRUS MACULATUS Gahan

The females are purplish black with four pale blue-green spots on the mesoscutum, one anteriorly on each side of the median line and another on the scapulae. The first abdominal tergite is brassy green, the following tergites are green except for broad black apical borders. The males are similar to the females except the abdomen is short and blunt and there are no pale spots on the thorax.

It is found in Arizona, California, Illinois, Kansas, New Mexico, South Dakota, Utah and Washington. This species is considered to be an important parasite in Arizona and California. Urbahns (1919) discusses its life history and distribution. Other hosts which *T. maculatus* attacks are the sunflower seed weevil, *Desmoris julvus* (LeConte) and the alfalfa gall midge, *Asphondylia websteri* (Felt).

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